

a means for creating a plurality of RF FM modulated pulse signals of identical shape and duration but different consecutive magnitude comprising a resistive multiport voltage divider/dividers electrically connected to said waveform generator/generators, said resistive multiport voltage divider/dividers providing plurality of said voltage pulse signals, a plurality of VCOs electrically connected to said resistive multiport voltage divider/dividers, a plurality of mixers electrically connected to VCRs, STALO or any other narrow-band or wide-band source of RF signals, and to a plurality of radiating elements in order to generate signals providing simultaneously the required beam or beams azimuth and elevation steering electronically and receiving target-echo return signals;

a means for producing the receiving signals which is electrically connected to plurality of LNAs amplifying the signals those are reflected from illuminated targets and received by a plurality of said radiating elements comprising a plurality of mixers electrically connected to said LNA outputs, a power combiner/combiners, and a plurality of said mixers creating said FM signals for transmitting part of said radar;

a means for processing target-echo return signals which is electrically connected to said receiving AESA or AESAs, said processing means being electrically connected with narrow band filters in order to enhance signal-to-noise ratio for detecting said target-echo return signals with said phase and power spectrum depending on angular target positions and range of a targets, and in order to get ultra-high angular and range resolution.

## ABSTRACT

An ultra-high resolution radar system and technique for transmit or receive AESAs or that yields performance substantially greater than, that of conventional radar systems and techniques while being simple and inexpensive to manufacture. The device comprises the transmit/receive flat or conformal AESA or AESAs steering beam or beams non-dispersively, and creating RF FM modulated pulse signals of identical shape and duration through a resistive multiport voltage divider/dividers electrically connected VCOs, RF mixers and STALO or any other narrow-band or wide-band source of RF signals, and to a plurality of radiating elements in order to generate signals providing simultaneously the required beam or beams azimuth and elevation steering electronically and receiving target-echo return pulse signals.

## References

- [1] U.S. Pat. No. 2,426,460, entitled SYSTEM FOR LOCATION A RADIATED-SIGNAL REFLECTOR, filed August 26, 1947, by H. M. Lewis.
- [2] D. G. Tucker, V. G. Welsby and R. Kendell, "Electronic Sector Scanning," *J. Brit. IRE*, vol. 18, August 1958.
- [3] US Patent 2,852,772, L. G. Gitzendanner, "Receive Scanning System," September 16, 1958.
- [4] D. E. N. Davies, "Radar Systems with Electronic Sector Scanning," *J. Brit. IRE*, vol. 18, December 1958.
- [5] D. G. Tucker, V. G. Welsby, L. Kay, M. J. Tucker, A. R. Stubbs and J. G. Henderson, "Underwater Echo-Ranging with Electronic Sector Scanning: See Trails on R.R.S. Discovery II," *J. Brit. IRE*, vol. 19, November 1959.
- [6] H. E. Shanks, "A New Technique for Electronic Scanning," *IRE Trans. Antennas Propag.*, vol. AP-9, 1961.
- [7] H. V. Cottony and A. C. Wilson, "A High-Resolution Rapid-Scan Antenna," *J. Research NBS*, vol. 65D, January-February, 1961.
- [8] D. E. N. Davies, "A Fast Electronically Scanned Radar Receiving System," *Br. Inst. Radio Eng. J.*, vol. 21, 1961.
- [9] D. F. Langenwalter and K. M. Stevenson, "Receiver Scanning System," *US Patent* 2,426,460, December 5, 1961.
- [10] S. P. Applebaum, "Electronic Scanning of Circular Arrays," *US Patent* 3,076,193, January 29, 1963.
- [11] P. V. Howells, "MOSAR-Array Multiplex Beamforming Technique," *Symp. Record, 9<sup>th</sup> Ann. Radar Symp.* (University of Michigan, Ann Arbor), June 1963.
- [12] D. E. N. Davies, "The Application of Electronic Sector Scanning techniques to Height-Finding Radar Systems," *IEE Conf. Electron. Res. Dev. Civil Aviation*, October 1963.
- [13] W. H. Kummer, A. T. Villeneuve and F. G. Terrio, "Scanning without Phase Shifters," *Electronics*, vol. 36, March 29, 1963.
- [14] D. E. N. Davies, "Beam-Positioning Radar Systems Utilizing Continuous Scanning Techniques," *Proc. IEE*, vol. 112, no. 3, 1965

- [15] M. A. Johnson, "Phased-Array Beam Steering by Multiplex Sampling," *Proc. of the IEEE*, vol. 56, no. 11, 1968.
- [16] A. K. Edgar and I. L. Jones, "Flood-Lighting with Nyquist Rate Scanning," *AGARD Conf. Proc.*, no. 66, 1970.
- 5 [17] M. F. Radford and R. Greenwood, "A Within-Pulse Scanning Height-Finder," *IEE Conf. On Radar and Future*, no. 105, 1973.
- [18] D. E. N. Davies, "High Data Rate Radar Incorporating Array Signal Processing and Thinned Arrays," *IEEE Int. Radar Conf.*, 1975.
- [19] S. Haykin, "Performance Analysis of a Radar Signal Processing System with  
10 Continuous Electronic Array Scanning," 1977, from "Array Processing Applications to Radar," *Benchmark Paper in Electrical Engineering and Computer Science*, vol. 22, 1980.
- [21] "Countermeasures. A Technical Evaluation of the Operational Effectiveness of the Planned US National Missile Defense System," April 2000, from Union of Concerned Scientists, MIT  
15 Security Studies Program, <http://www.ucsusa.org/publication.cfm?publicationID=345>
- [22] U.S. Pat. No. 5,351,053, entitled ULTRA WIDEBAND RADAR SIGNAL PROCESSOR FOR ELECTRONICALLY SCANNED ARRAYS, filed May 27, 1994, by Wicks, et al.
- [23] Nicodimus Retdian, Shigetaka Takagi, Nobuo Fujii, "Voltage Controlled Ring Oscillator with Wide Tuning Range and Fast Voltage Swing", [http://www.ap-asic.org/2002/proceedings/4A/4A-  
20 5.PDF](http://www.ap-asic.org/2002/proceedings/4A/4A-5.PDF)
- [24] U.S. Pat. Application No. 20,020,175,859, entitled PHASED ARRAY ANTENNA SYSTEM WITH VIRTUAL TIME DELAY BEAM STEERING, filed November 28, 2002, by Newberg, et al.